DOCUMENT RESUME

ED 059 752 LI 003 491

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TITLE	A Literature Survey of Operational and Emerging On-Line Library Circulation Systems.
INSTITUTION	Chicago Univ., Ill. Library Systems Development Office.
SPONS AGENCY	Council on Library Resources, Inc., Washington, D.C.; National Endowment for the Humanities (NFAH), Washington, D.C.
PUB DATE	Feb 72
NOTE	66p.; (25 References)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Computers; *Electronic Data Processing; *Information Systems; *Library Automation; *Library Circulation; Library Surveys; Literature Reviews; *On Line Systems

ABSTRACT

This document describes and compares on-line library circulation systems that have been reported as operational or developing, based on a non-comprehensive survey of published articles and public and restricted technical documentation. A checklist of components and features is used to tabulate if and how each system accommodates four selected functions (charge, discharge, renewal, and reserve) and if and how it uses any of four specially defined files (user file, item file, absence file, and log or transaction file). The emphasis is to document the data that are used; how they are stored, accessed, and transferred; and what messages, records, and circulation information result. Narrative synopses of the systems are also given. Complete accuracy and fairness are not claimed for the descriptions of systems presented in this document. (Author)

A LITERATURE SURVEY OF OPERATIONAL AND EMERGING ON-LINE LIBRARY CIRCULATION SYSTEMS*

by

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February 1972

Abstract

This document describes and compares on-line library circulation systems that have been reported as operational or developing, based on a non-comprehensive survey of published articles and public and restricted technical documentation. A checklist (40+ pages) of components and features is used to tabulate if and how each system accommodates four selected functions (charge, discharge, renewal, and reserve) and if and how it uses any of four specially defined files (user file, item file, absence file, and log or transaction file). The emphasis is to document the data that are used; how they are stored, accessed, and transferred; and what messages, records, and circulation information result. Narrative synopses of the systems are also given. Complete accuracy and fairness are not claimed for the descriptions of systems presented in this document.

*This work was supported by the University of Chicago Library Systems Development Office under CLR/NEH Grant No. EO-262-70-4658 from the Council on Library Resources and the National Endowment for the Humanities, for the development and operational testing of a library data management system.

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Introduction

Based on a survey of published articles and public and restricted technical documentation, this paper describes and compares on-line circulation systems that have been reported as operational or developing. To qualify, a system needed to perform any major circulation function on-line. The other major purpose of this paper is to demonstrate that a checklist of components and features is a useful tool for describing and designing systems.

Complete accuracy and fairness are not claimed for the descriptions of systems presented here. The uneveness of our treatment originates with the variety of sources we have surveyed. The articles and documentation are themselves out of date and of uneven purpose, content, level of detail, and quality. Any attempt to distill them into equivalent descriptions is therefore problematical. There have been possibilities for error in interpreting these sources, understanding the systems they describe, and giving our own descriptions in a format that omits much that has been said. Finally, the technique of tabulation that has been used to record hundreds of facts is error prone.

It has not been considered practical to obtain further information through either site visits to each system, or correspondence with their current operators in the necessary, detailed level. Our choice

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has been to either make this document available in its current state, or leave others to repeat the work for themselves. We have solicited the opinions of judges, who have advised the document's utility and urged its dissemination. We therefore release it, believing its deficiencies are outweighed by its potential to help librarians understand the current state of on-line circulation system technology and operations, and the major design choices that developers have made. These choices are elaborated in a conceptual paper entitled "Two Types of Designs for On-Line Circulation Systems" (1). In choosing criteria to describe these systems, we have followed a set of key factors of circulation system analysis and design presented in an earlier paper (2).

Status of Described Systems

The basic concepts of the described systems are likely fixed, although it should be emphasized that all have probably undergone normal maintenance and expansion. Nine of the systems have become operational: at West Sussex County Library, Illinois State Library, Redstone Scientific Information Center, Midwestern University Library, Northwestern University Library, Bell Laboratories Library, Eastern Illinois University Library, Ohio State University Library, and NASA-Houston Manned Spacecraft Center. It is understood that the Queen's University system is essentially developed, but has not yet begun operation. The Bucknell University Library system appears to be rapidly nearing operational status.

Developments or plans for on-line circulation systems at other libraries are known about, but not in sufficient detail to be summarized here. Substantial work has been carried out at Toronto University. Several other universities have given serious consideration to on-line circulation systems -- even to the point of receiving contractual proposals -- but their current positions are not known. This paper therefore considers systems described as operational in the literature, plus two other systems that are well documented and nearly operational.

Explanation of Table 1

Table 1 is a tabulation of selected components and features that have been described for the eleven systems. It describes the following functions and files:

1 Charge function
2 Discharge function
3 Renewal function
4 Reserve function
5 User file
6 Item file
7 Absence file
8 Log (or Transaction) file

The emphasis is to document the data that are used; how they are stored, accessed, and transferred; and what messages, records, and circulation information result. Performance characteristics are of primary concern and are also good indicators of general system software and file design. Be aware, however, that these gross tabulations are certainly no substitute for technical documentation of system specifications.

The table is simply designed. It lists a number of alternatives for selected features, and shows in adjacent columns which systems contain each. Uncircled system numbers are entered for features that are factually stated or strongly implied by available information. Circled numbers are entered for characteristics that may be inferred. No system number is given when we have no evidence or notion if or how a feature may have been implemented. A question mark is used if we guess about a feature, or do not know the details of one we believe must exist.

In some systems there are special relationships among components and features; often there is more than a single way of doing things. Some components may be functionally linked and always used together in a special way. In other relationships different components may be used as mutually exclusive alternatives; still another component might always

be used with whichever alternative is employed. We have tried to indicate some of the more significant relationships by putting letter superscripts with the system numbers entered in Table 1. For example, in section 1.1 of the table we see that in system 8 (Bell Laboratories' Library) it is possible for a user to charge a book either with his identification card (presenting it in person) or by writing or telephoning the necessary information about the book and himself. Despite whatever source records are used, we see in section 1.2 that the same basic data are always input to make the charge: function code, user number, item number. We further see in sections 1.4 and 1.5 that either user number or item number may be read from a machine-readable card or keystroked, depending upon the source records that are used.

Table 1 is unnecessarily full; it contains lists of alternatives that do not apply to some functions and files. This is because standard checklist forms for functions and files are used. However, this often has the advantage of showing other, possible features that have not been implemented.

The following comments explain sections of Table 1.

Criteria for Describing Functions

Four basic circulation system functions (charging, discharging, renewal, and reserve or hold) are described by Table 1 according to the following components and features:

- source records
- input data
- messages
- terminal features utilized
- terminals used

The term "source record" is used to indicate the physical source, or storage medium, of the input data. Under the term "input data," the actual data elements themselves are described. The word "messages" is used to describe resulting outputs. Several kinds of messages are possible: system confirmation (e.g., light signal, printout) of valid transactions; messages that indicate invalid transactions (e.g., because of malfunctions from incorrect inputs or system failure, or because of user, item, or transaction conditions); transaction evidence (i.e., receipts for users); and various batch-printed notifications. Charge evidence is separately described because in most systems it is a required output of the charge function. The terminal features needed for each system can be determined from its input/outputs. Following this, the actual terminal configuration used by each library is given.

Criteria for Describing Files

Table 1 describes several basic kinds of logical system files:

- User file
- Item file
- Absence file
- Log (or Transaction) file

In all cases these file names describe what are conceptually or logically single files, whereas in some systems the physical storage

of any may involve more than one physical file. The user file is simply a collection of records about users, containing such data as user number, name, and address. The term "item file" denotes what is, or approaches being, a comprehensive file of records for all titles or volumes, regardless of their circulation status. In contrast, an "absence file" contains records for only those items which have been charged or that are otherwise absent from their assigned locations. As will be shown, all systems either do or do not have an item file. This is a convenient starting point for tracing through a number of other distinctions that seem to follow, which is the purpose of another paper (1).

The term "log file" is applied to on-line files that record data from ongoing activities as they occur.

It has been found that the essence of a system can be quickly described by identifyin and characterizing files of this nature. Most on-line circulation systems have three of the four kinds of files (sometimes an item file and absence file are mutually exclusive), so that enumerations of their characteristics are really needed to show essential differences. The following checklist criteria have therefore been used:

- storage
- file organization
- file size
- new records added in on-line real-time mode
- new records added in batch mode
- one record per title
- multiple records per title
- one record per physical volume
- on-line accesses for transactions that add or modify system-held data
- on-line accesses for queries that do not add or modify system-held data
- batch printouts

The standard checklist form that has been used does not apply alike to all file descriptions, and for some is therefore excessive.

The definition and use of the criteria by which Table 1 describes files need to be explained. Major files in the systems that have been examined seem to be organized in one of three ways. Records in a sequentially organized file are physically stored in sequence according to a single key such as ID number or item number, and access to a wanted record is gained by reading sequentially through the file. In an indexed sequential file records are also stored in order by a specified key, but in addition a separate index is maintained to point to certain records so that accesses can be direct as well as sequential. In a randomized file the locations of records are calculated by entering data from each record into a randomizing algorithm, so that records are distributed as evenly as possible throughout the available storage area. Several of the systems use call numbers or accession numbers as seeds to calculate record addresses.

Disk files can be organized by any of these three methods. Since tape files can only be read by physically passing tape past a read point (i.e., the file can only be read sequentially), only sequential organizations have been used.

Tape files have been used in an on-line, real-time mode only to log transactions as they occur; all other uses have been for batch processing. Disk files, however, have been used for batch as well as on-line processing; some have been used only for batch processing.

New records are added to off-line files only in batch mode. For on-line log files on tape or disk, new records have been added sequentially. Otherwise, the only disk files to which new records have been added in on-line, real-time mode are those organized by indexed sequential or randomizing methods. Even so, new records are added only in batch mode to some of the large item files (over 200K records) that are organized by indexed sequential or randomizing methods.

A basic characterization of an item file is the relationship between machine-held logical records and bibliographic records. Does each title or volume require a single machine record unique to it, or may a single machine record represent more than one title or volume? Absence records, due to the nature of an absence file, usually have a one-to-one correspondence with physical volumes or items.

On-line accesses to circulation system files are generally made for either of two purposes: (1) read-only access to provide wanted information for queries; and (2) access of specific records to update system information by either directly changing these records, or transferring needed data from them to create new records of transactions (e.g., absence records). The number and nature of access keys used for queries and transactions are prime indicators of system capabilities, complexity, and file organization.

Once the character set required for input of query keys and the output of responses is known, basic requirements for the necessary terminal device are established. These relationships are indicated by the tabulation.

Beyond accessing a file on-line to answer queries and record transactions, remaining file utility lies in the kinds of products that are batch-generated from it. What batch products there are, and their frequency and format, are basic indicators that round out an understanding of a system.

The Described Systems

The following paragraphs synopsize the descriptions of systems given by Table 1.

1. West Sussex County Library System as of October 1968 (3,4,5,6)

In this system user and item numbers are machine-read from edge-punched user and item cards, and punched into paper tape in transaction sequence (both user and item numbers for charges; only item numbers for discharges). The paper tape is periodically read to batch update an absence file (stored on a data cell) that can be queried on-line by item number to determine if a book is on loan. Absence records consist of user number, item number, time data, and control data (e.g., what notices have been sent). Overdue notices are batch generated. Two manual author/title card files provide needed accesses: one file is ordered by author and gives the item number, the other is ordered by item number and gives author/title data. Item numbers are needed for on-line querying of absence status. Author/title data are manually added to computer generated notices when book information other than item number is required. Renewal is accomplished by a discharge-charge sequence. Users' reservations are handled manually, although on-line querying by item number is used to determine locations for sending recall notices. Matched item number queries of the absence file result in display of the item number, user number, name, address, charge date, and notices sent. A query of the user file by user number causes display of user name and address.

2. Illinois State Library System as of May 1968 (7,8)

User number and item data (call number, author, title, etc.) are machine-read from punched cards and logged on-line to a transaction file. An on-line check of the user file is made for the user's validity. A shipping list of items charged for shipment is printed as transaction evidence. For other charges individual date due slips are printed. Item cards are read on line for discharge and

their call numbers are compared to a reserve list kept on the transaction file disk: for reserved titles, messages are printed containing item call number, user number, and the date the reservation was placed. Further reserve processing is manual. During nightly processing records from the transaction file are listed and punched into cards (for backup) and then sorted by call number and used to update the absence file, which is kept off-line. Statistics on the day's activities are also printed at this time. Other batch processin- of the absence file produces overdue notices and monthly statistics. Analyses of the punched backup cards provide statistics on reserves.

3. Redstone Scientific Information Center System as of January 1968 (9)

The following is a full-text quotation of a news item that appeared in the January 15, 1968, issue of Library Journal (9).

> "The Redstone Scientific Information Center, at the Redstone Arsenal in Alabama, has reported success in its first experimental phase of using an on-line computer for library registration and circulation. In an 11-month period recently, computers and related equipment were used to satisfactorily store 7000 registration records and maintain records for about 33,000 books in circulation.
>
> Besides storage of registration data, the system provided for addition or deletion of patrons; modification of any of the 27 data elements in each individual registration; and capacity to look up patrons by name or social security number. In book circulation, the following functions were performed: loan, return, recall, reserve, list, and locate.
>
> The demonstration used two IBM-1050 remote terminals, each composed of a typewriter, a card reader, and a card punch which communicated with an IBM-7740 switching computer and an IBM-7010 which served as the central processing unit. Library-related data files were on an IBM-2301 disk unit, and an IBM-1311 disk pack unit attached to the 7740 contained the programs and message cues. The computer system was in constant teleprocessing use by others with other files and programs during all of this period, leading to some problems of delay.
>
> Numerous lessons were reported learned in the experiment, accordto Fred E. Croxton, director of the Redstone Scientific Information Center. These included: storage costs for files are more important than computing costs; there has to be a way to stop

a long printout and restate a problem; patrons using a terminal get impatient in a maximum of ten seconds if no results are forthcoming; and keying is to be avoided in as many transactions as possible if a patron is waiting. A suggested improvement was the use of function keys and badge or card readers.

Plans are being made to create a full-scale book control system consisting of ordering, receiving, cataloging, circulation, subject heading control, serials control, and current and retrospective document retrieval subsystems."

4. Midwestern University Library System as of October 1969 (10,11,12)

This system has an interesting history that involves two rare, perhaps unique, events. First, two families gave funds ($200,000) to the university with the stipulations that half be used to buy library materials and "that half would be combined with university funds to provide automation for the university, including an automated circulation system for the library" (12). Next, a second-generation IBM 1401 computer was purchased (because of relatively low cost) and modified to operate in an on-line mode.

Charges are made by machine-reading punched user and item cards; several things happen. The user number is checked against an on-line user status file to determine if the patron has outstanding fines or overdue books, or if the system does not have his address. If there are delinquencies, they are printed out, and the charge is blocked. If an address is needed, the charge is permitted and a need-an-address message is printed. The loan period precoded in each item card may be overridden by the status code in a user's card. A slip containing due date is printed as charge evidence. The charge record is added to an absence file, where it is accessible by item accession number and user number. Access is made by item number for on-line discharge, and a discharge message is printed. Fines notices are batch generated for books returned overdue. A special on-line query by user number results in a printout of all items charged to the patron, and his outstanding fines. User records are also updated on-line to record fines payments. Several major reports are batch-printed at the day's end: a list of that

day's transactions; a call number list of absent items, giving item accession number, short author-title, user number, and date due; a list by user of overdue books and the fines for each; a report of the number of items charged to each type of user or absence category (e.g., reserve collection and bindery charges); and fines notices and overdue notices. Locational queries are directed to the call number printout of the absence file. Principal on-line files are a user status file and an absence file, each of which appears to be organized by an indexed sequential method. In addition, pointers connect user records to absence file records, providing user number access to charges.

5. Queen's University System, Belfast, projections based on information as of July 1969 (13, 14, 15, 16, 17)

References 14 and 15 describe the system as it was planned, and reference 17 outlines the basic file organization and processing in a simplified, preliminary test system as of July 1969. These three sources are summarized here by presenting what we believe to be a reasonable picture of the full system, even though it was not implemented by July 1969. The basic design is for on-line access through a typewriter-like terminal (with a paper tape punch) to a file of absence records containing item call number, user number, date, and presumably processing data (e.g., notices sent, reserve request). On-line inputs are manually keyed, and at the same time punched into paper-tape at the terminal as backup. Charges are made by inputting user number and item call number. If an absence record is found for an item being charged, an error is reported. Only item call numbers are required for discharge; if no existing charge record is found, an error is reported. An absent item is reserved by input of user number and item call number, and a function code. Reserves cannot be placed on items for which there are no absence records. On-line queries by call number can be made to determine if an item is on loan. On-line file organization and processing are the subjects of reference 17. Initial absence records are stored at addresses

calculated by randomizing item call (Library of Congress classification) numbers. Records for subsequent transactions involving the same item, as known from its call number, are chained by pointers to the initial absence record. Each day the file is cleaned up, and records of obsolete transactions are put onto a free space list.

We want to emphasize that available documentation of this system may not describe the operational version that we hear has been recently finalized. It is possible that features beyond those described here have been included.

6. Northwestern University Library System as of Spring 1971 (18)

This system contains an on-line absence file that is randomly organized on item call number. Punched user and item cards are machine-read on-line as charge inputs. Item cards presently contain only call number and other locational (e.g., library or collection code) and identification (e.g., edition, volume, copy) data. Charge slips containing item call number, user number, and due date are terminal printed. This system is unique among on-line circulation systems in that users may self-charge items. Users simply insert identification and item cards into IBM 1030 data collection devices that are located in bookstack areas. On-line queries of the absence file by item call number are conducted on a keyboard/printer terminal (IBM 2740). Charge, discharge, renewal, and reserve functions are all performed on-line with thorough checks of item or transaction status and on-line terminal reports of error conditions. The system batch produces an extensive set of messages relating to each of the basic functions: e.g., overdue notices, fines notices, recall notices to users, expired recall notices to users, book availability notices. The system is well documented by reference 18.

7. Bucknell University Library System as of March 1971 (19)

This system is still under development; although its basic design concept has been outlined (19), a number of details are not yet

available. The system is predicated upon an absence file that is accessed on-line for charges, discharges, reservations, and queries. Punched user and item cards are machine-read by custom-built transaction stations that handle charges and discharges. A strip printer is used to produce charge evidence containing item call number and due date. User and item status are checked at charge time. Absence records are directly updated for reservations, which are entered on a keyboard/printer terminal. The system is distinguished by the use of a mini-computer (PDP-8/L) through which circulation transactions are routed to a general purpose machine (XDS Sigma-7) that stores and manages the user file and absence file. The mini-computer supports the transaction stations and circulation system keyboard/printer, and also an on-line cassette tape unit (Compu/Corder Model 100) to which it logs transaction data when the central computer is down. When the system recovers, the mini-computer automatically sends it the accumulated transactions. File organization and access are not described in full, nor are the details of system messages.

8. Bell Laboratories' Library System as of April 1969 (20,21)

This system was obviously designed with great care for detailed library and user needs, particularly in regard to terminal queries and messages, and batched outputs. User and item files are maintained on-line; the history (or log) tape is off-line. The logical item file is actually two differently organized files with separate record formats. Fixed length book records (188 characters) are organized sequentially, and each contains fields for three loans and two reserves.. One book record may represent more than one physical volume; all copies and volumes are stored. Journal records contain 155 characters, and are organized by an indexed sequential method. Records of all copies and volumes are not stored, and must be keyboarded as variable data at transaction time. Trade catalogs and college catalogs are similarly handled with 155-character records, with the exception that each physical item is specifically recorded. Charges are made by inputting user and item numbers on a keyboard/

printer terminal with an attached punched card reader. If cards are not available to be machine read, the needed data are keyboarded. Ten function codes are used for on-line charge, discharge, renewal, and reserve. Twelve c ..y codes are used to obtain status and other factual information on users and items. Function codes are keyboarded; user and item data may be keyboarded or card read. Status and error checks are reported by terminal messages. Batch reports include overdue notices, loan lists, statistics, titles-in-demand list, reserve queue aging report, missing items list, loans by subject and department, and a zero activity list of items. These two references describe the many well-planned features of this system.

9. Eastern Illinois University Library System as of June 1971 (22)

This system is based on an item file of records that are updated on-line to indicate charges, discharges, and reserves. Punched item and/or user cards are machine-read for charges and discharges. In backup mode, transaction data are punched into cards. Only the item call number plus accession number data are read from item cards; these are sufficient keys to access matching item records. Reservations are entered by keystroking user and item data at an IBM 2260 Display Station terminal. On-line file queries are also conducted on the 2260. The item file may be queried by item call number plus accession number to get an exact match to a single record, or by a classification number to get a file scan of corresponding records. A query by user number will result in a display of charge records for that user (the access or indexing technique is not described). The user file may be queried by user number for an exact record match. A user file scan is also possible, based upon input (partial, if desired) of the user's last name. Until more 2260's are available, a call number printout of absent items will be furnished for self-queries by users. Various subject (call number) lists of items in the collection are made from the item file. An on-line transaction tape is used to log activities for backup, as well as for batch

generation of statistical reports and overdue lists and notices, for which data are assumed to be extracted from the item file. Reference 22 is a published article and consequently does not document the system to full depth.

10. Ohio State University Library System as of Summer 1971 (23,24)

This is a big on-line circulation system with sophisticated access capabilities. Lately it has come to be called a remote catalog access system. Reference 23 gives a concise overview; reference 24 provides a technical documentation that is recommended for its description of system files, capabilities, and processing. The system maintains on-line a user file, item file, absence file, and log file (the user file was put permanently on-line after references 23 and 24 were prepared). In addition, there are two other major files: a fines file, and an author/title access file. The processing and interaction among these and a number of other files are more extensive than can be described in our summary. The read-only item file is randomized by item call number, but it may also be accessed by an author/title key (called "algorithm") that consists of the first 4 characters of the main entry plus the first 5 characters of the first significant word or words of the title. The second five characters can be blanked to provide author-only access. Access by author/title key is made through use of the author/title access file (algorithm file). The item file is also accessible by an item record or accession number (title number) that is assigned sequentially to new records entering the file. A title-number file serves as an index to the item file for this function. Queries, charges, discharges, renewals, and reserves are all conducted on-line from either CRT (IBM 2260) or keyboard/printer (IBM 2740) terminals. Since the author/title key accesses a set of matching records, file searches by author/title are conducted only on the IBM 2260, which displays up to 30 records or lines (an arbitrary limit). Once a wanted record is identified, however, the full record may be accessed by item record (title) number. Call-number, exact-match accesses can

be made on either an IBM 2260 or IBM 2740. The absence file ("circulation and save" file) in this system contains records for all absent and reserved items. It is randomized by item record (title) number, and is accessed in conjunction with the item file for queries and to record transactions; this file is updated on-line to record changing item status. Data are also written on-line to the transaction log file, which records information that is to be batch processed later. It contains transaction backup information, data to produce various notices, and fines data that are used to update the fines file. The fines file is an off-line, batch processing file organized sequentially by user number; it contains records for delinquent users. There are no punched user or item cards in the system; all transaction inputs are keystroked. Documentation of this system should be read. There are many attractive features and optional ways of doing things; Table 1 gives an incomplete picture.

11. NASA-Houston Manned Spacecraft Center System as of March 1971 (25)

This library is more properly called the Technical Library of the Manned Spacecraft Center, Houston. The "on-line interactive book-library-management system" does not contain a user file, which makes it unique among the systems surveyed. It does maintain an item (master history) file and a log (daily transaction) file on-line, in addition to an on-line cross-reference file that provides accesses to the item file by user name and call number. The item file is sequentially organized by item accession number, and charges are made by directly updating item records upon inputs of function code, item number, user last name and initials, an address code of several characters, and a due date. Item records can be directly queried by item number. Through use of the cross-reference file the item file may also be queried by call number to display records of all items with that number, and by user name to display all items charged to a user. Reservations are placed by inputting call number and function code; an on-line reserve list of call numbers is automatically checked for each item being charged, renewed, or discharged. Teletype KSR 35

terminals are used to keyboard and printout user and item data and function codes. In transactions for which item numbers are input to identify items (charges, renewals, discharges, some queries), the system responds with a call number for the operator to verify against the item. An alphanumeric hardcopy record containing all keystroked inputs and printout of system responses is produced for charges, renewals, discharges, and queries. Upon update each item file record is copied to the log file, which is used for backup and to record counts of transactions as they occur. New records are added to the item file by on-line inputs of the following data: function code, item accession number, call number, copy, edition, publication year, author's last name and initials, and title. A number of printed products are batch-produced from the item file: (1) comprehensive (inventory) lists of items ordered by item accession number and call number; (2) a list of charged items, by user name; (3) a list of delinquent users; and (4) circulation statistics. Reference 25 is a good technical document, but does not say how many titles, volumes, or users the system accommodates. The system seems to be well-conceived and very efficient for its environment. The simplicity of item records and the beneficial uses of the item file make this a system worth understanding.

Computers Used

With the possible exceptions of systems 1,2, and 4, (West Sussex County, Illinois State Library, and Midwestern University), we do not believe that the nature of available computing power has been the decisive factor in determining basic system design. That is, the differences among system designs are probably due to other factors. It would be interesting to investigate the circumstances and decisions that led to these differences.

The West Sussex County system was apparently written for an IBM 1401, but later converted to run on an IBM 360/40 with 256K, under OS. The Illinois State Library runs on an IBM 1710 System, which consists

of an IBM 1620 Model 1 computer with 20K of core, plus four disk drives and other peripherals. The Midwestern University system was developed on an IBM 1401 with 16K that runs with a Hybrid Operating System which permits time-sharing among three programs. The Queen's University preliminary system was developed on an ICL 1907.

The Northwestern University system runs on an IBM 360/30 with 64K. The Eastern Illinois University system operates on an IBM 360/50 with 262K, under OS. The Bucknell University system, as previously mentioned, will utilize a PDP-8/L and share an XDS Sigma-7. The Redstone Scientific Information Center system was developed for an IBM 7740 switching computer that worked in tandem with an IBM 7010 as a central processing unit. The Ohio State system runs on an IBM 360/50 with 512K, under OS. The Bell Laboratories system runs on an IBM 360/40 with 262K, under OS. The NASA-Houston system was implemented on a UNIVAC 418 computer with a Fastrand II drum.

Table 1 TABULATED DESCRIPTIONS OF OPERATIONAL AND EMERGING ON-LINE CIRCULATION SYSTEMS

1. West Sussex County Library
2. Illinois State Library
3. Redstone Scientific Information Center
4. Midwestern University Library
5. Queen's University Library, Belfast
6. Northwestern University Library
7. Bucknell University Library
8. Bell Laboratories Library
9. Eastern Illinois University Library
10. Ohio State University Library
11. NASA-Houston Manned Spacecraft Center

SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
1 CHARGE FUNCTION											
1.1 Source records			?								
punched user card or badge	1	2		4		6	7	8[a]	9		
printed user card					5					10[a]	11
citation of user data											
written								8[b]			
spoken (telephone or desk transaction)								8[b]		10[b]	
punched item card	1	2		4		6	7	8[a,b]	9		
item itself (e.g., imprinted call number, book label)					5					10[a]	11
citation of item data											
written (mailed)								8[b]			
spoken (telephone or desk transaction)										10[b]	(11)
terminal slide or switch		2				6	7		9		
1.2 Input data			?								
function (transaction) code	1	2		4	5	6	7	8	9	10	11
user number (Social Security or other)	1	2		4	5	6	7	8	9	10	
user name											11
user status code				4		6	7		9		
item identification or accession number	1	2		4				8		x 10[a]	11
item record display number or address										10[b]	
item call number		2		4	5	6	7			x 10[a]	
item call number and accession number									9		
item copy, volume, part, etc.		2		(4)		6	7			x 10	
author data		2		4			7				
title data		2		4			7				
other bibliographic data						6					

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
1 CHARGE FUNCTION (continued)											
1.2 Input data (continued)											
publication date				(4)			7				
loan period code				4			7				
fines payment code											
user's mail code											11
due date											11
1.3 Messages											
terminal responses											
signal light						6[a]	7		9[a]		
printout		2		4	5	6[b]	7	8	9[b]	10[a,b]	11
CRT display										10[b]	
transaction confirmed		?		4	5	6[b]		8	9[a]	10	11
transaction malfunction						6[a]	7	8	9[a]		
invalid user		2		4		6	7	8		10	11
outstanding fine				4							
overdue book				4			7				11
no user address				4						10	
invalid user number or card		2				6[b]	7	8			
invalid item number						6[b]		8			
invalid function code						6[b]		8			
item record not in file									9[b]		
request for item number											11
item not charged											11
call number and location of available copies											
call number returned as validity check											11

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
1 CHARGE FUNCTION (continued)											
1.3 Messages (continued)											
item is charged, call number returned as validity check					5	6[b]			9[b]		
request for user name, mail code, and due date											11
return to proper library											
item reserved											
stop charge or renewal				(4)		6[b]			9[b]		
hold notice (save) for clerk											
book availability notice for user											
send recall-item notice to user											
item cannot be reserved											
item cannot be renewed											
item is overdue, for clerk											
[Also tabulated as file outputs]											
batch fines notices	1	2		4	5	6	7	8	9	10	11
batch overdue notices											
batch recall notices											
batch book availability notices											
batch purchase alerts for multiply-requested items											
1.4 Terminal features utilized			?								
set variable slide(s) or switch(es)						6	7		9		
for function code		?				6	7		9		
for user data						6[a]			9[a]		
machine-read punched user card	1	2		4		6[b]	7	8[a]	9[b]		

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
1 CHARGE FUNCTION (continued)											
1.4 Terminal features utilized (continued)											
machine-read punched item card.	1	2		4		6	7	8	9		
machine-read function card.....											
keystroke input of user data...					5			8[b]		10	11
keystroke input of item data...					5			8[b]		10	11
keystroke input of function code.....					5			8		10	11
signal light.....							7		9		
alphanumeric printout.....		2		4	5	6	7	8	9	10	11
numeric-only printout.....											
CRT display.....										10[b]	
punch data into paper tape.....	1				5						
punch data into punch card.....											
1.5 Terminals used											
IBM 1030 Data Collection System.....		2		4		6			9		
1031 Input Station (card reader, optional slides)..		2		4		6			9		
1033 Printer.....		2		4		6			9		
1034 Card Punch.....									9		
IBM 1050 Data Collection System.....			3					8			
1052 Printer-Keyboard.....			?					8			
1056 Card Reader.....			?					8[a]			
IBM 2260 Display Station.....										10[a,b]	
Printer.....										10	
IBM 2740 Communications Terminal.....										10[a]	
IBM 2741 Communications Terminal.....											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
1 CHARGE FUNCTION (continued)											
1.5 Terminals used (continued)											
Elliot Automation circulation data collection system.....	1										
Teletype KSR 35.....											11
Keyboard/printer with paper tape punch.....					5						
Custom built transaction station.....							7				
Strip printer.....							7				

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
1 CHARGE FUNCTION (continued)											
1.6 Charge evidence											
pre-dated date-due slip	1[a]								9[a]		
date-stamped item date-due slip	1[b]				5				9[b]		
date-stamped punched item card								8			
terminal-printed charge or paging slip		2		4		6	7			10	11
date due				4		6	7			10	11
user name										10	11
user number				4		6				10	
user address										10	
item call number						6	7			10	11
user mail code											11
item identification or accession number				4							11
author data										10	
title data										10	
terminal-printed shipping list with date due		2									
1.7 Special services											
patron self-charging						6					
mail or delivery of charged items to users								8		10	
paging, with charge evidence used as paging slip										10	
self-queries by users									9		

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
2 DISCHARGE FUNCTION											
2.1 Source records			?								
punched discharge badge				4					9		
printed user card											
citation of user data											
written											
spoken (telephone or desk transaction)											
punched item card	1	2		4		6	7	8[a]	9		
item itself (e.g., imprinted call number, book label)					5			8[b]		10	11
citation of item data											
written (mailed)											
spoken (telephone or desk transaction)											
terminal slide or switch						6	7				
2.2 Input data			?								
function (transaction) code	1	2		4	5	6	7	8	9	10	11
user number (Social Security or other)											
user name											
user status code											
item identification or accession number	1			4				8		x10[a]	11
item record display number or address										10[b]	
item call number		2		4	5	6	7			x10[a]	
item call number and accession number									9		
item copy, volume, part, etc.		2		(4)		6	7			x10	
author data		2		4			7				
title data		2		4			7				
other bibliographic data						6					

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2 DISCHARGE FUNCTION (continued)											
2.2 Input data (continued)											
publication date				(4)			7				
discharge date code						6					
fines payment code						6					
mail code											
due date											
2.3 Messages											
terminal responses											
signal light						6[a]	7				
printout		2		4	5	6[b]	7	8	9	10[a,b]	11
CRT display										10[a]	
user transaction receipt										10	
transaction confirmed		2		4	5	6[a]		8		10	
transaction malfunction						6[a]	7				
invalid user											
outstanding fine											
overdue book											
no user address											
invalid user number											
invalid item number						6[b]		8			
invalid function code						6[b]		8			
item record not in file					5					10	
request for item number											
item not charged					5	6[b]		8			
call number and location of available copies											
call number returned as validity check											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
2 DISCHARGE FUNCTION (continued)											
2.3 Messages (continued)											
item is charged, call number returned as validity check											
request for user name, mail code, and due date											
return to proper library								8			
item reserved											
stop charge or renewal											
hold notice (save) for clerk		2	(3)	(4)	5	6[b]	7	8	9	10	
book availability notice for user					5			8			
send recall-item notice to user											
item cannot be reserved											
item cannot be renewed											
item is overdue, for clerk						6	7		9	10	
[Also tabulated as file outputs]											
batch fines notices				4		6	(7)			10	
batch overdue notices											
batch recall notices											
batch book availability notices						6				10	
batch purchase alerts for multiply-requested items											
2.4 Terminal features utilized			?								
set variable slide(s) or switche(s)		2				6	7		9		
for function code		2				6	7				
for user data											
machine-read punched user card											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
2 DISCHARGE FUNCTION (continued)											
2.4 Terminal features utilized (continued)											
machine-read punched item card.	1			4				8[a]	9		
machine-read discharge badge...				4					9		
keystroke input of user data...											
keystroke input of item data...			(3)		5			8[b]		10	11
keystroke input of function code.....			?		5			8		10	11
signal light.....							7				
alphanumeric printout.....		2		4	5	6	(7)	8	9	10[a,b]	11
numeric-only printout.....											
CRT display.....										10[a]	
punch data into paper tape.....	1				5						
punch data into punch card.....											
2.5 Terminals used											
IBM 1030 Data Collection System.....		2		4		6			9		
1031 Input Station (card reader, optional slides)..		2		4		6			9		
1033 Printer.....		2		4		6			9		
1034 Card Punch.....											
IBM 1050 Data Collection System.....			3					8			
1052 Printer-Keyboard.....			?					8			
1056 Card Reader.....			?					8			
IBM 2260 Display Station.....										10[a,b]	
Printer.....										10	
IBM 2740 Communications Terminal.....										10[a]	
IBM 2741 Communications Terminal.....											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
2 DISCHARGE FUNCTION (continued)											
2.5 Terminals used (continued)											
Elliot Automation circulation data collection system.....	1										
Teletype KSR 35.....											11
Keyboard/printer with paper tape punch.....					5						
Custom built transaction station.....							7				
Strip printer.....											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
3 RENEWAL FUNCTION											
3.1 Source records			?								
punched user card or badge	1[a]					6[a]					
printed user card											
citation of user data											
written						6[b]					
spoken (telephone or desk transaction)	1[b]									10	
punched item card	1[a]	2				6[a]		8[a]			
item itself (e.g., imprinted call number, book label)											11
citation of item data											
written (mailed)						6[b]		(8[b])			
spoken (telephone or desk transaction)	1[b]							(8[b])		10	(11)
terminal slide or switch								8[b]			
3.2 Input data			?								
function (transaction) code		2				6		8		10	11
user number (Social Security or other)	1					6[a]				10	
user name											
user status code											
item identification or accession number	1					6[a]				x10[ab]	11
item record display number or address						6[b]				10[b]	
item call number	(2)					6[a,b]				x10[a,b]	
item call number and accession number											
item copy, volume, part, etc.	(2)									x10	
author data	(2)										
title data	(2)										
other bibliographic data						6[a]					

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
3 RENEWAL FUNCTION (continued)											
3.2 Input data (continued)											
publication date											
discharge date code											
fines payment code											
mail code											
due date										10	11
3.3 Messages											
terminal responses											
signal light						6[a]					
printout		2				6[b]		8		10[a]	11
CRT display										10[b]	
user transaction receipt						6[b]				10	
transaction confirmed		2				6[b]		8		10	11
transaction malfunction						6[b]		8		10	
invalid user		2				6					
outstanding fine											
overdue book											11
no user address											
invalid user number		2				6[b]					
invalid item number						6[b]		8			
invalid function code						6[b]		8			
item record not in file										10	
request for item number											
item not charged											
call number and location of available copies											
call number returned as validity check											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
3 RENEWAL FUNCTION (continued)											
3.3 Messages (continued)											
item is charged, call number returned as validity check											11
request for due date											11
return to proper library											
item reserved											
stop charge or renewal		2				6[b]		8		10	
hold notice (save) for clerk											
book availability notice for user											
send recall-item notice to user											11
item cannot be reserved											
item cannot be renewed						6[b]		8		10	
item is overdue, for clerk						6[b]		8		10	
batch fines notices											
batch overdue notices											
batch recall notices											
batch book availability notices											
batch purchase alerts for multiply-requested items											
3.4 Terminal features utilized			?								
set variable slide(s) or switche(s)		2				6[a]					
for function code											
for user data											
machine-read punched user card	1[a]					6[a]					

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
3 RENEWAL FUNCTION (continued)											
3.4 Terminal features utilized (continued)											
machine-read punched item card.	1[a]	2				6[a]		8[a]			
machine-read function card.....											
keystroke input of user data...	1[b]					6[b]					
keystroke input of item data...	1[b]					6[b]		8[b]			11
keystroke input of function code.....								8			11
signal light.....											
alphanumeric printout.....											11
numeric-only printout.....											
CRT display.....										10[b]	
punch data into paper tape.....	1										
punch data into punch card.....											
3.5 Terminals used											
IBM 1030 Data Collection System.....		2				6[a]					
1031 Input Station (card reader, optional slides)..		2				6[a]					
1033 Printer.....		2				6[a]					
1034 Card Punch.....											
IBM 1050 Data Collection System.....			3					8			
1052 Printer-Keyboard.....			?					8			
1056 Card Reader.....			?					8[a]			
IBM 2260 Display Station.....										10[a,b]	
Printer.....										10	
IBM 2740 Communications Terminal.....						6[b]				10[a]	
IBM 2741 Communications Terminal.....											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
3 RENEWAL FUNCTION (continued)											
3.5 Terminals used (continued)											
Elliot Automation circulation data collection system.....	1[a]										
Teletype KSR 35.....											11
Keyboard/printer with paper tape punch.....	1[b]										
Custom built transaction station.....											
Strip printer.....											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
4 RESERVE (HOLD OR SAVE) FUNCTION											
4.1 Source records											
punched user card or badge	?		?	?		6[a]	(7)				
printed user card					5						
citation of user data											
written								8[a]			
spoken (telephone or desk transaction)						6[b]	(7)	8[b]	(9)	(10)	
punched item card	?			?							
item itself (e.g., imprinted call number, book label)											
citation of item data				?							
written (mailed)								8[a]			
spoken (telephone or desk transaction)					5	6	(7)	8[b]	(9)	(10)	(11)
terminal slide or switch				?							
4.2 Input data			?								
function (transaction) code		(2)		?	5	6	(7)	8	9	10	11
user number (Social Security or other)		(2)		?	5	6	(7)	8	9	10	
user name											
user status code									9		
item identification or accession number				?				8		10[a]	
item record display number or address						6				10[b]	
item call number		(2)			5	6	(7)			10[a]	11
item call number and accession number									9		
item copy, volume, part, etc.		(2)								10	
author data											
title data											
other bibliographic data											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
4 RESERVE (HOLD OR SAVE) FUNCTION											
4.2 Input data (continued) (continued)											
publication date											
discharge date code											
fines payment code											
mail code											
date reserve placed		(2)									
4.3 Messages											
terminal responses											
signal light			?				?				
printout	?				5	6		8			11
CRT display									9		
user transaction receipt											
transaction confirmed					5	6		8	9		
transaction malfunction											
invalid user								8			
outstanding fine											
overdue book											
no user address											
invalid user number						6		8			
invalid item number								8			
invalid function code								8			
item record not in file											
request for item number											
item not charged											
call number and location of available copies								8			
call number returned as validity check											

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10. Ohio State University Library
11. NASA-Houston Manned Spacecraft Center

SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
4 RESERVE (HOLD OR SAVE) FUNCTION (continued)											
4.3 Messages (continued)											
item is charged, call number returned as validity check											11
request for user name, mail code, and due date											
return to proper library											
item reserved											
stop charge or renewal											
handle second save manually						6					
book availability notice for user											
send recall-item notice to user											
item cannot be reserved											
item cannot be renewed											
item is overdue, for clerk											
user's place in reserve queue								8			
batch fines notices											
batch overdue notices											
batch recall notices					5	6				10	
batch book availability notices						6					
batch purchase alerts for multiply-requested items											
4.4 Terminal features utilized		?		?							
set variable slide(s) or switche(s)											
for function code		?		?							
for user data											
machine-read punched user card		?		?							

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
4 RESERVE (HOLD OR SAVE) FUNCTION (contd.)											
4.4 Terminal features utilized (continued)											
machine-read punched item card.		?									
machine-read function card.											
keystroke input of user data.			?		5	6	(7)	8	9	10	
keystroke input of item data.			(3)		5	6	(7)	8	9	10	11
keystroke input of function code.			?		5	6	(7)	8	9	10	11
signal light.											
alphanumeric printout.					5					10[b]	11
numeric-only printout.											
CRT display.										10[a]	
punch data into paper tape.					5						
punch data into punch card.											
4.5 Terminals used											
IBM 1030 Data Collection System.		?		?							
1031 Input Station (card reader, optional slides).		?		?							
1033 Printer.											
1034 Card Punch.											
IBM 1050 Data Collection System.			3					8			
1052 Printer-Keyboard.			?					8			
1056 Card Reader.			?								
IBM 2260 Display Station.									9	10[a,b]	
Printer.										10	
IBM 2740 Communications Terminal.						6				10[a]	
IBM 2741 Communications Terminal.											

RESERVE FUNCTION

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
4 RESERVE (HOLD OR SAVE) FUNCTION											
4.5 Terminals used (continued) (contd.)											
Elliot Automation circulation data collection system.....											
Teletype KSR 35.....											11
Keyboard/printer.....					5		7				
Custom built transaction station.....											
Strip printer.....											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
5 USER FILE											
5.1 Storage					?						
data cell	1										
disk		2	3	4	(5)	?	7	8	9	10	
drum											
tape											
off-line (used for batch processing)					(5)	?					
on-line	1	2		4			7	8	9	10	
5.2 File organization											
sequential			?		?		?				
indexed sequential	1	2			(5)	(6)				10	
randomized				4				8	9		
by user number											
by user name	1	2		4	(5)	(6)	?	8	9	10	
by item (or item record) identification or accession number											
by item call number											
by item call number and accession number											
by transaction occurrence											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
5 USER FILE (continued)											
5.3 File size											
1.6K records											
3K records											
4K records				4							
7K records			3								
20K records								8	9		
30K records		2									
35K records											
50K records											
60K records										10	
150K records	1										
235K records											
250K records capacity; 100K currently											
1200K records capacity; 800K currently											
5.4 New records added in on-line mode			?				7				
5.5 New records added in batch mode	1	(2)		(4)				8	9	10	
5.6 One record per title											
5.7 Multiple records per title											
5.8 One record per physical volume											
5.9 On-line accesses for transactions that add or modify system-held data											
read-only		(2)						?	9	?	
on-line record update			?	4			7				
by user number			?	4					9	10	

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
5 USER FILE (continued)											
5.9 On-line accesses for transactions that add or modify system-held data (continued)											
by user name		2	?				?	8	9		
by item identification or accession number											
by item call number											
by item call number and accession number											
by author/title key											
by author key											
by title key											
add, delete, modify record							7				
for charge				4				(8)			
for discharge				4							
for renewal								(8)			
for placing reserve											
for fines payment				4							
multiple-accesses per transaction				4						10	
5.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data)	1		3	4			7	8	9		
by user number	1		3	4			(7)	8	9[a]		
how many items are on loan to								8			
what items are charged to				4				8			
who is first on reserve queue for								8			
is user on a reserve queue								8			

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
5 USER FILE (continued)											
5.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data) (continued)											
who is user								8			
display record for user	1		3					8	9[a]		
what fines are owed for				4			(7)				
by user name			3[a]						9[b]		
by item identification or accession number											
what is the status of title											
what is the status of copy											
by item call number											
by classification number scan											
by item call number and accession number											
by author/title key										10	
by author key											
by title key											
by display line or record number											
by library location symbol: what overnight items are still out											
display a set of corresponding records									9[b]	10	
display exactly matched record(s)			(3[a])	4				8	9[a]		
inquiry terminal device											
IBM 1031				4							
IBM 1033				4							

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
5 USER FILE (continued)											
5.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data) (continued)											
IBM 1052			(3)					8			
IBM 2260									9		
IBM 2740	1										
IBM 2741											
Teletype KSR 35											
Keyboard/printer							7				
5.11 Batch printouts											
list of users											
by user number											
by user name						6					
of charged items											
of outstanding fines											
reserve queue again report											
overdue notices for users											
fines notices for users											
recall notices for reserve items											
expired recall notices											
book availability notices for reserved items											
list of overdue items											
list of delinquent users											
titles-in-demand list											
get-off-shelf list											
zero activity list											
missing (lost) items report											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
6 ITEM FILE											
6.1 Storage											
data cell											
disk								8	9	10	
drum											11
tape											
off-line (used for batch processing)											
on-line								8	9	10	
6.2 File organization											
sequential								8[a]			
indexed sequential								8[b]	9		
randomized										10	
by user number											
by user name											
by item (or item record) identification or accession number								8[a,b]			
by item call number										10	
by item call number and accession number									9		
by transaction occurrence											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
6 ITEM FILE (continued)											
6.3 File size											
1.6K records											
3K records											
4K records											
9K records								[b]			
20K records											
30K records											
35K records								[a]			
50K records											
60K records											
150K records											
235K records									9		
250K records capacity; 100K currently											
1200K records capacity; 800K currently										10	
6.4 New records added in on-line mode								[b]			
6.5 New records added in batch mode								[a]	9	10	
6.6 One record per title								[a]		10	
6.7 Multiple records per title								[b]			
6.8 One record per physical volume									9		11
6.9 On-line accesses for transactions that add or modify system-held data											
read-only								[a]		10	
on-line record update								[b]	9		
by user number											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
6 ITEM FILE (continued)											
6.9 On-line accesses for transactions that add or modify system-held data (continued)											
by user name											
by item identification or accession number								8			11
by item call number										10	
by item call number and accession number									9		
by author/title key										10	
by author key											
by title key											
by display line or record number											
for charge								8	9	10	11
for discharge								8	9	10	11
for renewal								8		10	11
for placing reserve								8	9	10	
for fines payment											
multiple-accesses per transaction										10	
6.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data)								8	9	10	11
by user number								8	9[a]		
how many items are on loan to											
what items are charged to									9[a]		
who is first on reserve queue for								8			
is user...on reserve											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
6 ITEM FILE (continued)											
6.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data) (continued)											
who is user											
display record for user											
what fines are owed for											
by user name											11
by item identification or accession number								8		10[a]	11
what is the status of title								8			
what is the status of copy								8			
by item call number										10[a]	11
by classification number scan									9[b]		
by item call number and accession number									9[c]		
by author/title key										10[a]	
by author key										10[a]	
by title key											
by display line or record number										10[b]	
by library location symbol: what overnight items are still out								8			
display a set of corresponding records									9[b]	10	
display exactly matched record(s)								8	9[a,c]	10	
inquiry terminal device											
IBM 1031											
IBM 1033											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
6 ITEM FILE (continued)											
6.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data) (continued)											
IBM 1052								8			
IBM 2260									9	10[b]	
IBM 2740										10[a]	
IBM 2741											
Teletype KSR 35											11
Keyboard/printer											
6.11 Batch printouts											
item cards and labels								8			
list of users											
by user number											
by user name											
of charged items											
of outstanding fines											
reserve queue aging report								8			
overdue notices for users								8			11
fines notices for users								8			
recall notices for reserve items											
expired recall notices											
book availability notices for reserved items											
list of overdue items											
list of delinquent users											11
titles-in-demand list								8			
get-off-shelf list								8			
zero activity list								8			
missing (lost) items report								8			

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
6 ITEM FILE (continued)											
6.11 Batch printouts (continued)											
list of snag items										10	
daily list of transactions											
list of absent (charged and other) items								8			11
by item (accession or identification) number											
by item call number								(8)			
by title											
author data											
title data											
item loan period											
item due date											
user number											
user status											
by user name											11
purchase alert for multiply-requested items											
list of items by subject (call number)									9		11
list of items by item (identification or accession) number											11
book catalog of items (that gives item numbers)								8			
general statistical reports											11
loan type statistics											
item class (subject) usage statistics											
library location (department) statistics											
transaction type statistics											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
7 ABSENCE FILE			?								
7.1 Storage											
data cell	1					6					
disk		2	3	4	5		7			10	
drum											
tape											
off-line (used for batch processing)		2									
on-line	1			4	5	6	7			10	
7.2 File organization			?				?				
sequential	1	2									
indexed sequential				4							
randomized					5	6				10	
by user number				4							
by user name											
by item (or item record) identification or accession number	1									10	
by item call number		?			5	6					
by item call number and accession number											
by transaction occurrence											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
7 ABSENCE FILE (continued)											
7.3 File size											
1.6K records											
3K records				4							
4K records											
7K records											
20K records											
30K records											
33K records			3								
50K records						(6)					
60K records											
150K records											
235K records											
250K records capacity; 100K currently										10	
1200K records capacity; 800K currently											
7.4 New records added in on-line mode			?	4	5	6	7			10	
7.5 New records added in batch mode	1	2									
7.6 One record per title											
7.7 Multiple records per title							7			10	
7.8 One record per physical volume	1	2	?	4	5	6	7				
7.9 On-line accesses for transactions that add or modify system-held data											
read only											
on-line record update				4	5	6	7			10	
by user number											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
7 ABSENCE FILE (continued)											
7.9 On-line accesses for transactions that add or modify system-held data (continued)											
by user name											
by item identification or accession number				4						10	
by item call number					5	6	?				
by item call number and accession number											
by author/title key											
by author key											
by title key											
by display line or record number						6[a]					
for charge				4	5	6	7				
for discharge				4	5	6	7				
for renewal						6	7				
for placing reserve				?	(5)	6[a]	7				
for fines payment											
multiple-accesses per transaction						6[a]				10	
7.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data)	1			4	5	6	7			10	
by user number				4							
how many items are on loan to											
what items are charged co.				4							
who is first on reserve queue for											
is user...on reserve											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
7 ABSENCE FILE (continued)											
7.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data) (continued)											
who is user											
display record for user											
what fines are owed for				4							
by user name											
by item identification or accession number	1									10	
what is the status of title											
what is the status of copy										10	
by item call number					5	6	(7)				
by classification number scan											
by item call number and accession number											
by author/title key											
by author key											
by title key											
by display line or record number											
display user record related to charged item	1										
display a set of corresponding records						6				10	
display exactly matched record(s)	1			4	5					10	
inquiry terminal device											
IBM 1031				4							
IBM 1033				4							

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
7 ABSENCE FILE (continued)											
7.10 On-line accesses for inquiries that do not add or modify system-held data (i.e., that only cause displays of data) (continued)											
IBM 1052											
IBM 2260											
IBM 2740	1					6[a]				10	
IBM 2741										10	
Teletype KSR 35											
Keyboard/printer					5		7				
7.11 Batch printouts											
list of users											
by user number				4							
by user name						(7)					
of charged items				4	5	6	7				
of outstanding fines				4							
reserve queue aging report											
overdue notices for users	1	2		4	5	6	7			10	
fines notices for users				4							
recall notices for reserve items											
expired recall notices						6					
book availability notices for reserved items											
list of overdue items				4							
list of delinquent users											
titles-in-demand list											
get-off-shelf list											
zero activity list											
missing (lost) items report										10	

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6. Northwestern University Library
7. Bucknell University Library
8. Bell Laboratories Library
9. Eastern Illinois University Library
10. Ohio State University Library
11. NASA-Houston Manned Spacecraft Center

SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
7 ABSENCE FILE (continued)											
7.11 Batch printouts (continued)											
list of snag items				4	5						
daily list of transactions				4							
list of absent (charged and other) items											
by item (accession or identification) number											
by item call number				4							
by title											
author data				4							
title data				4							
item loan period											
item due date				4							
user number				4							
user status											
user name											
purchase alert for multiply-requested items										10	
list of items by subject (call number)							(7)				
list of items by item (identification or accession) number											
book catalog of items											
general statistical reports		(2)					7			10	
user statistics				4							
loan type statistics				4							
charge statistics for item categories: e.g., fiction, music	1										
library location (department) statistics											
transaction type statistics						6					

Table 1 TABULATED DESCRIPTIONS OF OPERATIONAL AND EMERGING ON-LINE CIRCULATION SYSTEMS

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
8 LOG (or TRANSACTION) FILE											
8.1 Storage											
data cell						6					
disk		2									
drum											11
tape					5		7	8	9	10	
off-line (used for batch processing)					5			8			
on-line		2				6	7		9	10	
8.2 File organization											
sequential		2			5	6	7	(8)	(9)	10	11
indexed sequential											
randomized											
by user number											
by user name											
by item (or item record) identification or accession number								(8)			
by item call number					(5)						
by item call number and accession number											
by transaction occurrence		2				6			(9)	10	11
8.3 File size											
1.6K records											
3K records											
4K records											
9K records		2									
20K records											
30K records											
35K records											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
8 LOG (or TRANSACTION) FILE (contd)											
8.3 File size (continued)											
50K records											
60K records											
150K records											
235K records											
250K records capacity; 100K currently											
1200K records capacity; 800K currently											
8.4 New records added in on-line mode		2				6	7		9	10	
8.5 New records added to batch mode					5			8			11
8.6 Used to batch-update absence file		2									
8.7 Used for system backup					5		7		9	10	11
8.8 Used for data gathering, analysis, and reporting						?		8		10	11
by user class											
by transaction type						(6)					11
by item class		2						8			
by library location		2						8			
8.9 Batch printouts											
list of users									(9)		
by user number											
by user name											
of items charged to library departments									(9)		
of outstanding fines											
reserve queue aging report											

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
8 LOG (or TRANSACTION) FILE (contd)											
8.9 Batch printouts (continued)											
overdue notices for users...									9	10	
fines notices for users.....										10	
recall notices for reserve items.....						6				10	
expired recall notices.....											
book availability notices for reserved items.....						6				10	
list of overdue items.....									9		
list of delinquent users....											
titles-in-demand list.....											
get-off-shelf list.....											
zero activity list.....											
missing (lost) items report.										10	
list of snag items.....										10	
daily list of transactions..											
list of absent (charged and other) items.....									9		
by item (accession or identification) number.....											
by item call number....									9		
by title.....											
author data.....								(9)			
title data.....								(9)			
item loan period.....											
item due date.....									9[a]		
transaction date.....									9[b]		
user number.....									9		
user status.....									9		

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SYSTEM COMPONENTS AND FEATURES	1	2	3	4	5	6	7	8	9	10	11
8 LOG (or TRANSACTION) FILE (contd.)											
8.9 Batch printouts (continued)											
user name.....											
purchase alert for multi-ply-requested items.....										10	
list of items by subject (call number).....											
list of items by item (identification or accession) number.....											
book catalog of items.....											
general statistical reports.								8	9	10	
user statistics.....											
loan type statistics.....											
item class (subject) usage statistics.....		2						8			
library location (department) statistics.....		2						8			
transaction type statistics.											

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